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(54) Apparatus for providing audible instructions or status information for use in a digital television system

(57) A digital television system receives transmitted television information in the form of a stream digital packets representing video and audio information in compressed form. A packet transport unit (1507) routes the digital packets to respective digital video and audio signal processing sections according to header information contained in the packets. The digital processing sections (1511,1513) decode and decompress the respective packets to form sequences of digital words (Y,U,V,L,R) which are subsequently converted to analog form. Apparatus for providing audible messages, such as operating instructions and status information, in tone or voice form includes a memory (1529) for storing digital representations of the audible messages in the same compressed form which the transmitted audio packets have, and a controller (1527) for selectively directing the digital representations to the packet transport unit (1507) when it is desired to provide the audible messages. The digital representations of the audible messages are automatically routed by the transport unit (1507) to the digital audio signal processing section (1513) which will decode and decompress the digital representation of the audible messages in the same manner as it does the transmitted audio packets. As a result, analog versions of the audible messages will be produced.

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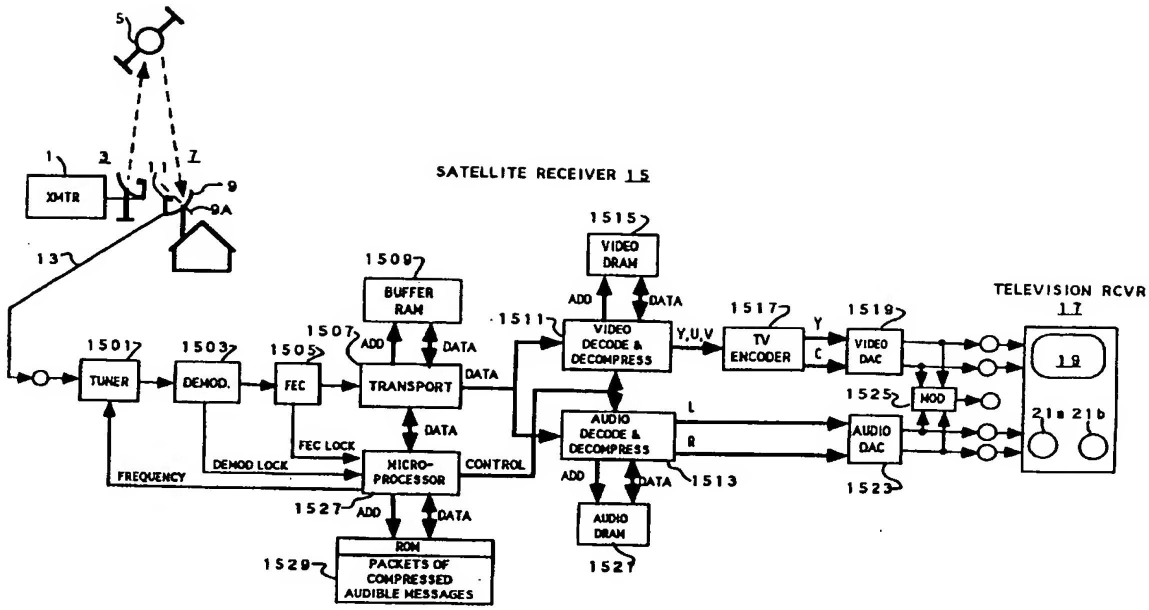
XMTR
SATELLITE RECEIVER 15
VIDEO DRAM
BUFFER RAM
TELEVISION RCVR 17
ADD
DATA
TUNER
DEMOD.
FEC
TRANSPORT
VIDEO DECODE & DECOMPRESS
Y,U,V
TV ENCODER
Y
C
VIDEO DAC
MOD
AUDIO DECODE & DECOMPRESS
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R
AUDIO DAC
FEC LOCK
DEMOD LOCK
FREQUENCY
MICRO-PROCESSOR
CONTROL
AUDIO DRAM
ROM
PACKETS OF COMPRESSED AUDIBLE MESSAGES

that antenna assembly 7 is not yet with the limited azimuth range needed for proper reception. On the other hand, if both proper tuning is achieved and error correction is possible at any of the search frequencies, the alignment apparatus causes a continuous tone to be produced to indicate to a user that the antenna assembly 7 is within the limited azimuth range needed for proper reception.

The user is instructed in the owner's manual accompanying satellite receiver 15 to rotate antenna assembly 7 around the mounting pole by a small increment, for example, three degrees, when a beep occurs. Desirably, the user is instructed to rotate antenna assembly 7 once every other beep. This allows the completion of the tuning algorithm before antenna assembly 7 is moved again. (By way of example, a complete cycle of the tuning algorithm in which all search frequencies are searched may take three to five seconds.) The user is instructed to repetitively rotate antenna assembly 7 in the small (three degree) increment (once every other beep) until a continuous tone is produced.

The user is instructed that once a continuous tone has been produced, to continue to rotate antenna assembly 7 until the continuous tone is again no longer produced (that is, until the tone is muted) and then to mark the respective antenna azimuth position as a first boundary position. The user is instructed to thereafter reverse the direction of rotation and to rotate antenna assembly 7 in the new direction past the first boundary. This causes the continuous tone to be generated again. The user is instructed to continue to rotate antenna assembly 7 until the continuous tone is again muted and to mark the respective antenna position as a second boundary position. The user is instructed that once the two boundary positions have been determined, to set the azimuth angle for optimal or near optimal reception by rotating antenna assembly 7 until it midway between the two boundary positions. The centering procedure has been found to provide very satisfactory reception. The antenna alignment mode of operation is then terminated, for example, by making a menu selection.

The manner in which the continuous tone and tone bursts (beeps) are generated will now be described.

ROM 1529 stores digital data encoded to represent an audible tone at a particular memory location. The tone data is stored in the same compressed form, for example, according to the MPEG audio standard, as the as a payload or data portions of the transmitted audio packets. The tone data is stored as a data packet without header information. To produce the continuous audible tone, microprocessor 1527 causes the tone data to be read from the tone data memory location of ROM 1529 and to be transferred to the audio data memory location of buffer RAM 1509 associated with transport 1507. The audio memory location of transport RAM 1509 in which the tone data is stored is the same memory location in which the data portions of transmitted audio packets are stored. During this process, microprocessor 1527 causes the transmitted audio data portions of the transmitted packets to be discarded by not directing them to the audio memory location of RAM 1509.

The tone data stored in RAM 1509 is transferred via the data bus to audio decoder 1513 in the same manner as the data portions of the transmitted audio packets. The tone data is decompressed by audio decoder 1513 in the same manner as the data portions of the transmitted audio packets. The resultant decompressed digital audio signal is converted to analog signals by DAC 1523. The analog signals are coupled to speakers 21a and 21b which produce the continuous audible tone.

To generate a tone burst or beep, microprocessor 1527 causes the tone data to be transferred to audio decoder 1513 in the same manner as described above, but causes the audio response to be muted except for a short time by causing a muting control signal to be coupled to audio decoder 1513 via the control bus.

The above described process for generating the audible tone and tone bursts can be initiated at the beginning of the antenna alignment operation. In that case, microprocessor 1527 generates a continuous muting control signal until either the generation of the continuous tone or tone burst is required.

The tone burst and continuous tone may alternatively be generated in the following way. To produce the tone burst, microprocessor 1527 causes the tone data to be read from the tone data memory location of ROM 1529 and to be transferred to audio decoder 1513 via transport 1507 in the manner described above. To generate a continuous tone, microprocessor 1527 cyclically causes the tone data to read from the tone data memory location of ROM 1529 and to be transferred to audio decoder 1513. In essence, this produces an almost continuous series of closely spaced the tone bursts.

A user voice message is produced in the same manner as the tone and tone bursts. Data representing the voice message is stored in ROM 1529 in the same compressed form, for example, in accordance with the MPEG audio compression format, as the data portions of the transmitted audio packets. Under the control of microprocessor 1527, the storage of the data portions of newly transmitted audio packets in the audio section of buffer

RAM 1509 is interrupted, the current contents of the audio section of RAM 1509 are discarded, and the compressed voice data is read from ROM 1529 and transferred to the audio section of RAM 1509. Thereafter, the voice data is transferred via transport 1507 and the data bus to audio decoder 1513 where it is decompressed. The resulting sequence of digital words is converted to analog form by DAC 1523. After the voice message has been completed, the normal processing of transmitted audio packets is reinitiated.

The voice data is stored in ROM 1529 in data packets (packets without headers). If the voice message is short, all of the packets of voice data can be transferred from ROM 1529 to the audio section of RAM 1509 at one time. For longer voice messages, the packets of voice data are transferred in segments.

It is desirable that the voice message data be in monophonic (rather than stereophonic form) to reduce the amount of data which has to be stored in ROM 1509. According to the MPEG standard, 256 Kbits (32 Kbytes of 8 bit bytes) per second provide CD (compact disk) stereophonic quality sound. For monophonic voice information less than 4 Kbytes per second is required to provide one-half to one second of voice information.

Voice messages can be used in a variety of circumstances to provide instructions or status information. For example, the voice messages may be used to facilitate the alignment of antenna assembly 7. The voice message may be use to instruct the user to "move" or "stop moving" antenna assembly dependent on the condition of a signal strength representative signal generated by tuner 1501 or demodulator 1503. The user voice messages can also be used to indicate user caused system operating errors ("Please try again."), operating instructions ("Select channel.") or system status ("Waiting for input.").

While the present invention has been described in terms of a specific embodiment, it will be appreciated that modifications may be made. For example, while the invention has been described with respect to a satellite television system, it may be employed in other types of systems which receive audio information in compressed form. In addition, while the invention has been described with respect to a system which receives audio information which is compressed and encoded according to the MPEG audio standard, it is also applicable to systems which receive audio information compressed and encoded according to other standards, such as NICAM, Dolby™ AC-3 or MUSICAM. NICAM is an audio compression and encoding standard used for terrestrial television transmission in Europe. The Dolby™ AC-3 compression standard is proposed for terrestial high definintion television (HDTV) in the United States. MUSICAM is a MPEG-based compression standard and is described together with a commercially available CDQ2000 encoder/decoder in the "CDQ2000 Reference Manual" Published in 1992 by Corporate Computer Systems, Inc., New Jersey, USA. Further, structural aspects of the embodiment may be modified in to suit a particular circumstance. For example, audio DRAM 1521 may be omitted, depending on the data rate, or incorporated in audio decoder and decompression unit 1513. These and other modifications are contemplated to be within the scope of the invention defined by the following claims.

Claims

1. In a television system (15) for processing received digital signals representing video and audio information which has been compressed for transmission, said digital signals being organized in a stream of multiplexed packets, each of said packets including payload data representing a particular type of information, header data for identifying the particular type of information represented by the payload data and error correction data, apparatus characterized by:

   means (1505) responsive to said received stream of digital signals for correcting errors occurring in said packets according to the respective error correction data to produce an error corrected stream of multiplexed data packets;

   a buffer memory (1509) including a memory location for storing payload data representing transmitted video information and a memory location for storing payload data representing transmitted audio information;

   a transport (1507) responsive to said error corrected stream of packets for routing payload data of said packets to ones of said memory locations of said memory section (1509) according to the respective header data contained in said packets;

   a decoder (1511) for decompressing payload data representing video information to produce a digital signal representing decompressed video information (Y,U,V);

   means for coupling a signal responsive to said digital signal representing said decompressed video information (Y,U,V) to an image reproducing device (19);

   a decoder (1513) for decompressing payload data representing audio information to produce a digital signal representing decompressed audio information (L,R);

   means for coupling a signal responsive to

said digital signal representing said decompressed audio information (L,R) to an sound reproducing device (21a,21b);

a data bus (DATA) for coupling payload data stored in said memory locations of said buffer memory (1509) to respective decoders (1511,1513);

a control memory (1529) for storing data representing audible message information which has been compressed in the same manner as the transmitted audio information; and

a controller (1527) for selectively routing said audible message data from said control memory (1529) to said memory location of said buffer memory (1509) for temporarily storing said payload data representing transmitted audio information so that said audible message data is thereafter routed to said audio decoder (1513).

2. The apparatus recited in claim 1, characterized in that:

said means for coupling said signal responsive to said digital signal representing said decompressed video information (Y,U,V) to said image reproducing device (19) includes a digital-to-analog converter (1519) for converting said digital signal representing said decompressed video information (Y,U,V) to an analog video signal; and

said means for coupling said signal responsive to said digital signal representing said decompressed audio information (L,R) to said sound -reproducing device (21a,21b) includes a digital-to-analog converter (1523) for converting said digital signal representing said decompressed audio information (L,R) to an analog audio signal.

3. The apparatus recited in claim 1, further characterized in that:

said audible message data corresponds to a voice message.

4. The apparatus recited in claim 1, further characterized in that:

said audible message data corresponds to a tone message.

5. The apparatus recited in claim 4, further characterized in that:

said tone message is a continuous tone.

6. The apparatus recited in claim 4, further characterized in that:

said tone message is an intermittent tone.

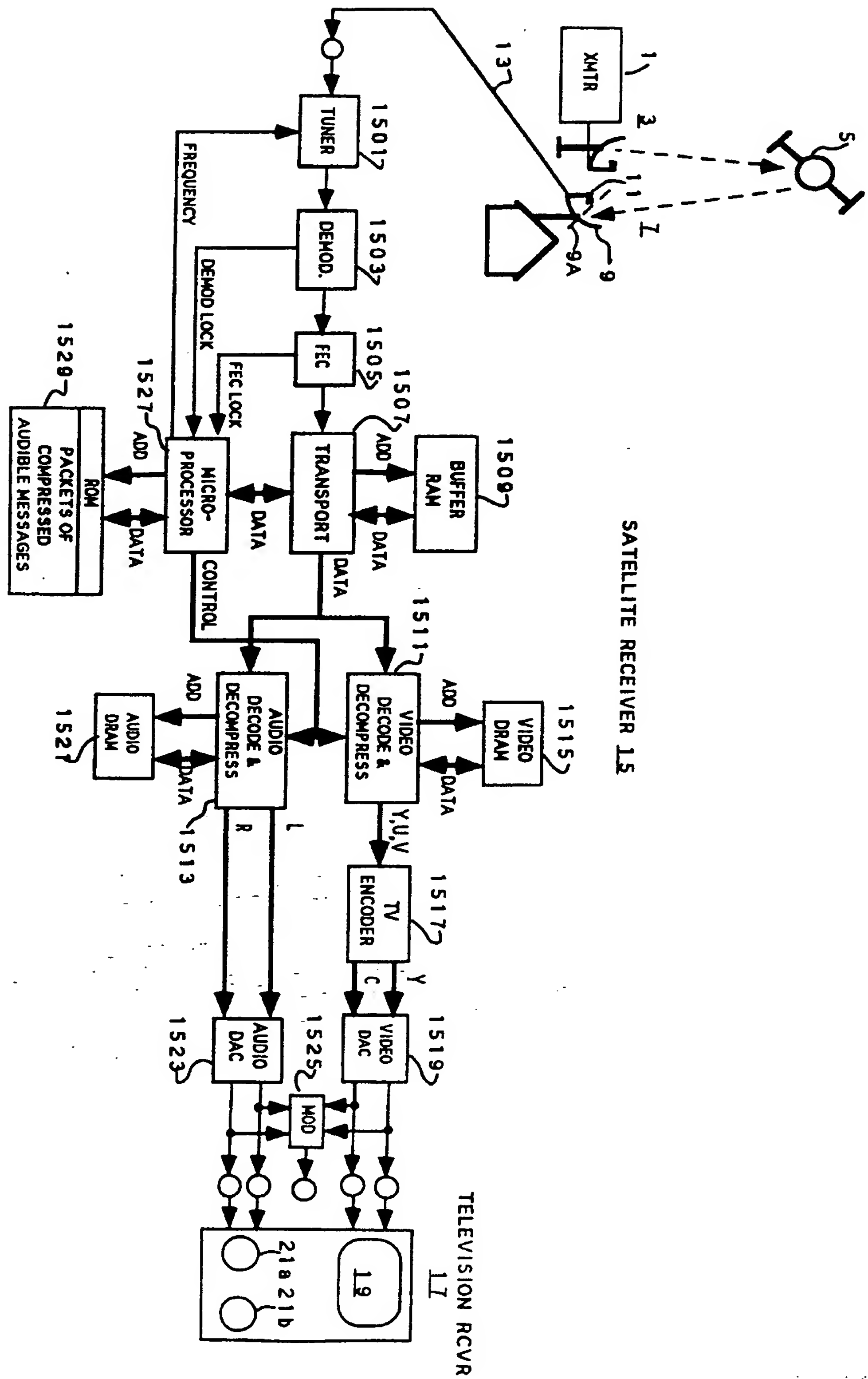
7. The apparatus recited in claim 1, further characterized in that:

said control memory (1529) stores data representing tone information which has been compressed in the same manner as the transmitted audio information; and

said controller (1527) selectively routes said tone data from said control memory (1529) to said memory location of said buffer memory (1509) for temporarily storing said payload data representing transmitted audio information so that said tone message data is thereafter routed to said audio decoder (1513).

8. The apparatus recited in claim 7, further characterized in that:

said controller (1527) periodically generates a signal (CONTROL) for causing said means for coupling a signal responsive to said digital signal representing said decompressed audio information (L,R) to a sound reproducing device to periodically interupt said signal responsive to said digital signal representing said decompressed audio information after said controller (1527) has routed said tone data from said control memory (1529) to said memory location of said buffer memory (1509) for temporarily storing said payload data representing transmitted audio information.


SATELLITE RECEIVER 15
XMTR
TUNER
DEMOD.
FEC
TRANSPORT
BUFFER RAM
MICRO-PROCESSOR
ROM
PACKETS OF COMPRESSED AUDIBLE MESSAGES
VIDEO DECODE & DECOMPRESS
VIDEO DRAM
AUDIO DECODE & DECOMPRESS
AUDIO DRAM
TV ENCODER
VIDEO DAC
AUDIO DAC
MOD
FREQUENCY
DEMOD LOCK
FEC LOCK
CONTROL
ADD
DATA
Y,U,V
TELEVISION RCVR 17
19
21a 21b